Demand Response Research Center

Application Manual:
PG&E DBP/CPP AutoDR Control Design Strategies & Preparation

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Introduction

This manual is intended to introduce and guide Facility Controls Programmers and Technical Coordinators (TC) of available signaling infrastructure from Pacific Gas and Electricity's (PG&E) Demand Response Automation Server (DRAS) for Automated Demand Response (AutoDR) programs' day-ahead and day-of event notifications using the Client and Logic with Integrated Relay (CLIR) and DRAS Web Service (WS) Software-Client. These event and price signals constitute services of AutoDR programs such as, Critical Peak Pricing (CPP) and Demand Bidding Program (DBP) and can also be used for automating strategies for "preparation of load reduction" for controlled load reduction. This manual does not cover the Energy Management Control Systems (EMCS) programming and logic as DR strategies to facility's HVAC, lighting systems, or other controls.

The following rules, models, and assumptions are considered for day-ahead/day-of DBP and day-ahead CPP signaling infrastructure. The CLIR Relays are included as default and equivalent DRAS software-client service parameters are in parenthesis wherever applicable:

- CLIR Relay status or DRAS software-client service request/response.
- Customers may either use a CLIR (hardware) or DRAS software-client.
- Optionally, load reduction preparation time considered for special customers.
- Relay 1 & 2 (getPrice = 1.0/3.0/5.0) determine NORMAL/MOD/HIGH event-modes and shall be used for planning multi-leveled load reduction strategy and per program rules.
- Assumes no day-ahead CPP/DBP event is issued before 12 p.m. or after 12 a.m. DBE
- Assumes no day-of DBP event is issued before 12 a.m. or after 6 p.m. DOE.
- Assumes customer is either participating in DBP or CPP.
- Set of rules or algorithms considered are:
  - Status of Relay 3 (isAPEEventPending = true) determines event pending.
  - Status of Relay 3 (isAPEEventPending = true) and event start time determines event start. Additionally, Relay 1 (getPrice = 3.0) status can be considered for CPP event start.
  - Status of Relay 3 (isAPEEventPending = false) and event end time determines event end. Additionally, Relay 1 and 2 (getPrice = 1.0) status can be considered for CPP event end.
  - For customers requiring load reduction preparation, program rules and status of CLIR Relay 3 (isAPEEventPending = true) shall be used to initiate preparation countdown.
  - Where applicable, consecutive events occurring during an event-period are determined on the status of CLIR Relay 3 (isAPEEventPending = true) at event end period.

Note: Day-of DBP event can be issued during event-period, and event pending can be active between 12 a.m. to 6 p.m., based on California Independent Systems Operator (CA ISO) "Warning Stage or higher." DR strategies can be derived from the information noted here.

Terminology

DBE: Day before Event or also called Day-Ahead event.
DOE: Day of Event
SPC: Shed/Load reduction preparation countdown
STm: Shed/Load reduction Time in minutes preparing curtailment
EIm: Event Issue time in minutes
ESm: Event Start time in minutes
AEm = ESm – EIm: Applicable Event start time in minutes on the hour
Relay 3: Event Pending Signal – CLIR only

Relay 2: High event-mode signal – CLIR only
Relay 1: Moderate event-mode signal – CLIR only
Price/Event-Mode: PL – DRAS Web Service client only (getPrice service)
Event Pending Signal: EPS – DRAS Web Service client only (isAPEEventPending service)

All Related Documentation

Depending on specific client technology in use, the table below lists all available documentation.

Document	Bundled w/	Audience	Utility	Program	Client Type	Version	Description
PG&E Application Manual	CLIR/ WS Client	Programmer/ TC	PG&E	CPP/DBP	CLIR/ WS Client	2.0-R3	Introduce and guide Facility Controls Programmer and TC of available signaling infrastructure from DRAS for AutoDR programs' day-ahead and day-of event notifications using the CLIR and Software Web Service (WS) Client.
CLIR User-Guide	CLIR	TC	IOU/ CAISO	CPP/DBP	CLIR	6.0-R2	Introduce and guide TC of AutoDR systems through pre and post site visit install procedures for the CLIR and to receive remote signals from Utility's DRAS.
Web Service (WS) API	WS Client	Programmer	IOU/ CAISO	CPP/DBP	WS Client	2.0-R2	Describes the API to securely connect and listen to the DRAS Web Service using SOAP to transport messages for the purposes of AutoDR using Open AutoDR (OpenADR) systems.

CLIR and Software-Client Triggers for Event Pending Signal

The DRAS communicates to the CLIR or DRAS software-client whether a DR event is pending (upcoming) for the facility. This signal is either day-ahead or day-of and can be used by the EMCS in addition to the load reduction event MODE signals for functions such as pre-cooling, preparing the loads for reductions, etc. This signal is reflected on Relay 3 (isAPEEventPending service – true/false) on CLIR as shown in the table below assuming a normally open connection is used (Note: If normally closed connections are used, the logic should be reversed):

Description	Triggers	Event Not Pending	Event Pending
CLIR	Relay 3	open	closed
Software	isAPEEventPending	false	true

CLIR and Software-Client Triggers for Event-Mode Signals

The DRAS communicates three different DR event-modes to the CLIR – normal, moderate or high (getPrice service – 1.0, 3.0, and 5.0 respectively). The EMCS in the facility is programmed to respond to either or all of these three event-modes based upon the state of the Relays 1 and 2 on the CLIR or the DRAS software-client. The table below shows the DRAS software-client response and states of the CLIR Relays for each mode assuming normally open connections are used (Note: If normally closed connections are used, the logic should be reversed):

Description	Triggers	Normal Mode	Moderate Mode	High Mode
CLIR	Relay 1	open	closed	closed
CLIR	Relay 2	open	open	closed
Software	getPrice	1.0	3.0	5.0

Time Synchronization and Consecutive Events

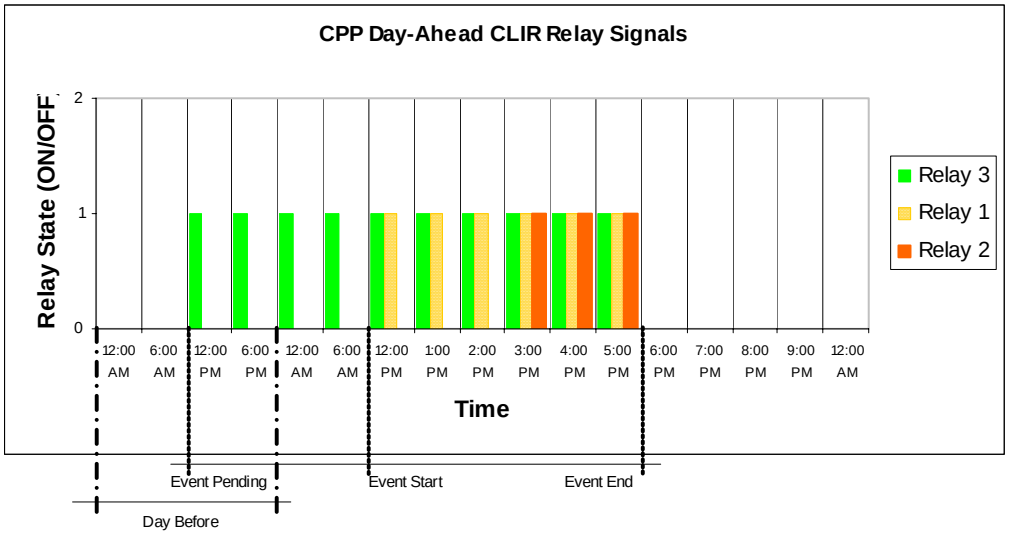
- Similar to DRAS, Network Time Protocol (NTP) synchronization with NIST time server, time.nist.gov, with poll interval of 15 minute or as appropriate is recommended.
- When applicable, consecutive day-ahead event issued ≥ 12 p.m. DOE during event-period, a day-ahead event preparation shall be triggered when Relay 3 is still active (EPS = true) and for CPP only, Relay 1 and 2 are inactive (PL = NORMAL) at event end period.

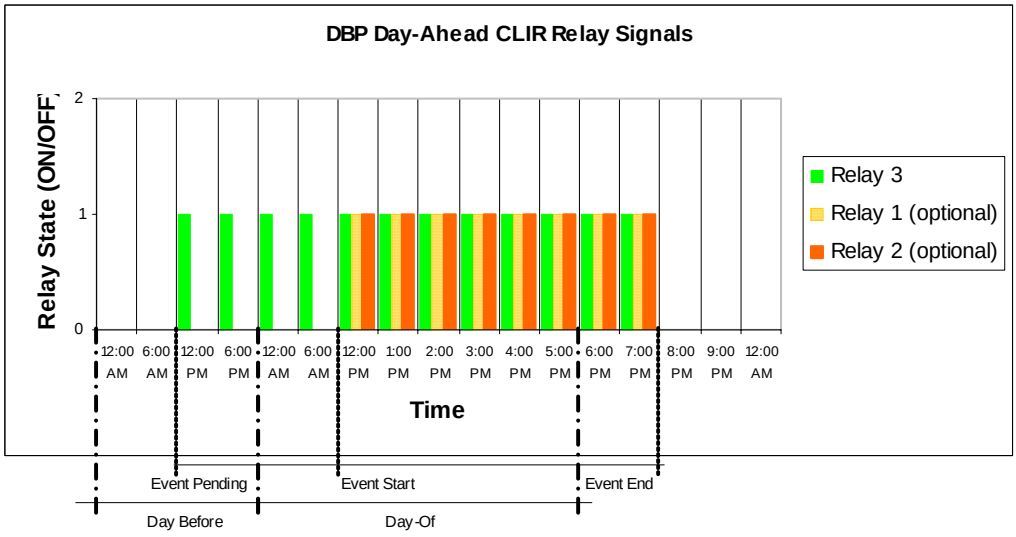
Note: For PG&E, Relay 3 goes inactive (EPS = true) and pauses for a short period after event-end before becoming active again and recognized by systems as day-ahead event.

DBP/CPP Day-ahead Event Scenario(s)

For day-ahead signal –DBP/CPP, event pending signal is issued after 12 p.m. DBE and before 12 a.m. DOE (Event begins at 12 p.m. DOE); the following changes occur:

- CLIR Relay 3 is active (EPS = true) < 12 a.m. DOE.
- CLIR Relay 1 and 2 are inactive. (PL = NORMAL). before event start
- Graphs below show state of CLIR Relays for day-ahead events.

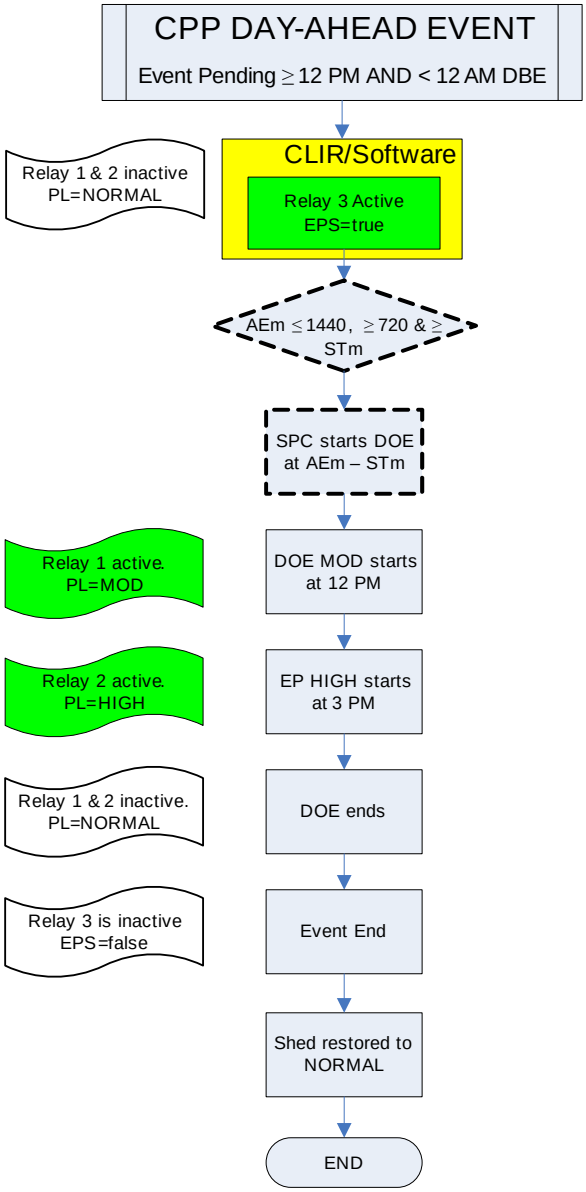


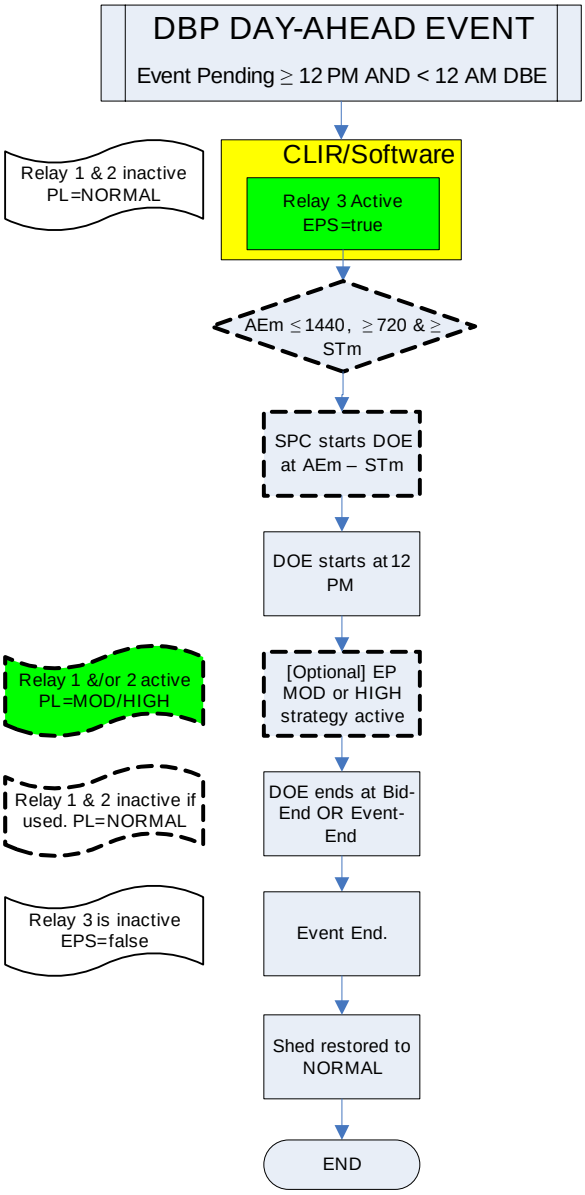


Note: In DBP, event-modes (PL = NORMAL/MOD/HIGH) are customer-specific and can be programmed to use any of the 3 event-modes during an event-period.

Scenario 1: For DBP/CPP DBE events where event pending is activated less than or equal to 24 hours and before 12 a.m. DBE; the following changes occur:

- Reduction starts at 12 p.m. DOE and for customers requiring preparation, countdown begins before 12 p.m. on DOE
- Load reduction ends at bid end time for DBP customers or end of event period, i.e. when Relay 3 is inactive (EPS = false) for CPP and DBP customers.
- Additionally, at event-end, Relay 1 & 2 are inactive (PL = NORMAL) for CPP customer.
- Flow/Process diagrams for both CPP and DBP scenarios are shown below.

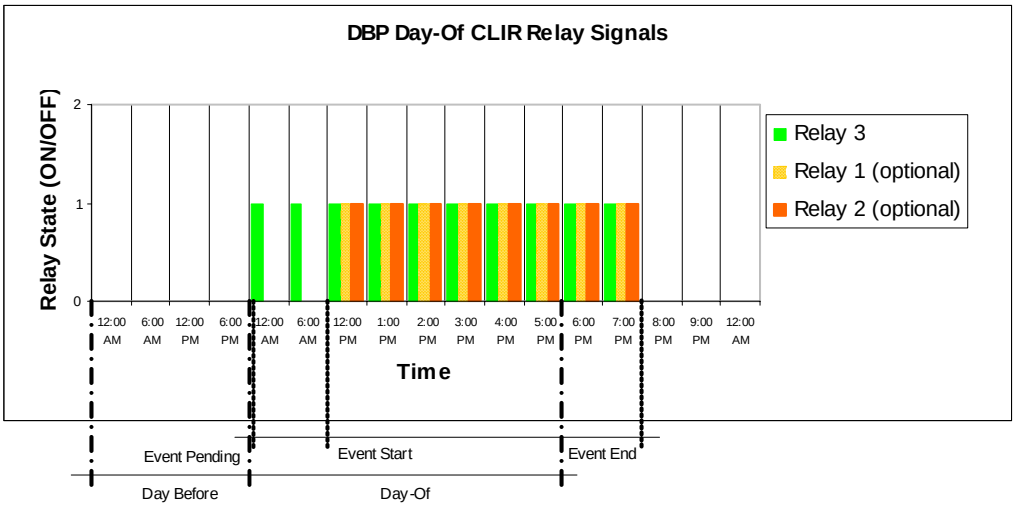




DBP Day-of Event Scenario(s)

For day-of signal – event pending signal issued after 12 a.m. and before 12 p.m. DOE; the following changes occur:

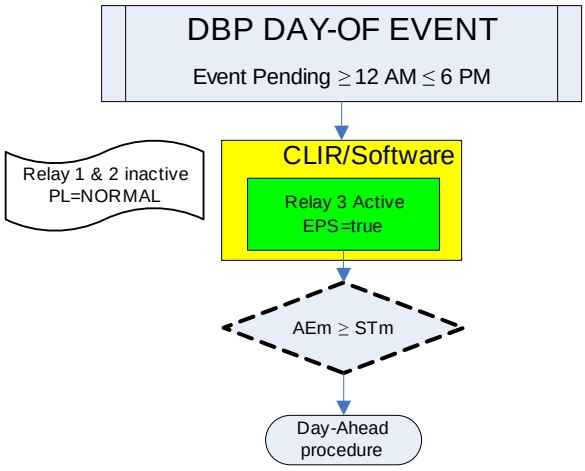
- Relay 3 active (EPS = true) ≥ 12 a.m. and ≤ 6 p.m. DOE for DBP.
- Relay 1 and 2 are inactive (PL = NORMAL) before event start.
- Assumes minimum 2 hour participation for DBP is required.
- Assumes no event is issued after 6 p.m. DOE.
- Graphs below show state of CLIR Relays for day-of events.



Note: In DBP, event-modes (PL = NORMAL/MOD/HIGH) are customer-specific and can be programmed to use any of the 3 event-modes during an event-period.

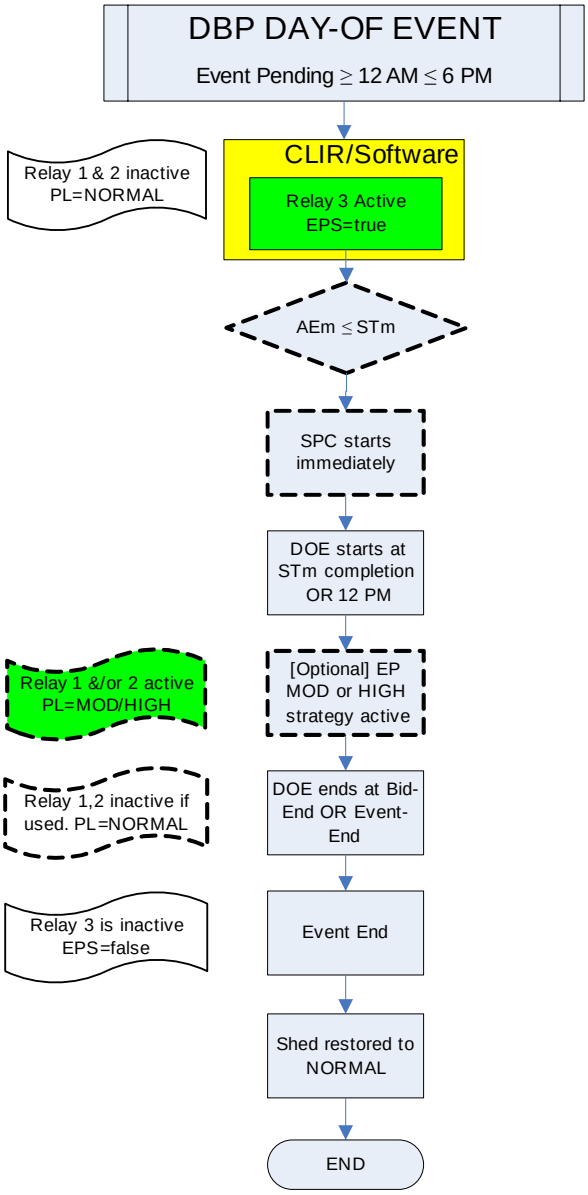
Scenario 1: For DBP customers requiring preparation and event pending or Relay 3 is active (EPS = true) at event start time greater than time required for load reduction process.

- Same as day-ahead strategies in scenario 1.
- Flow/Process diagram is shown below.



Scenario 2: For DBP customers requiring preparation and event pending or Relay 3 is active (EPS = true) at event start time less than or equal to time required for load reduction process.

- Reduction preparation countdown begins immediately. Relay 3 is active (EPS = true).
- Load reduction starts at ≥ 12 p.m. at end of countdown and calculated on the hour.
- Load reduction ends at bid time for partial bid customers and at the end of event for customers bidding full event period. Relay 3 is inactive (EPS = false) at event end.
- Flow/Process diagram is shown below.



Special Considerations for Day-of DBP Events

The following scenarios are for DBP customers only who need load reduction preparation time. They are included separately since the present rules for PG&E allow DBP day-of events to be issued at any time, even during the event period, e.g. between 12 p.m. and 6 p.m.

Note: In DBP, event-modes (PL = NORMAL/MOD/HIGH) are customer-specific and can be programmed to use any of the 3 event-modes during an event-period.

Scenario 1: When an event pending or Relay 3 is active (EPS = true) after 12 p.m. DOE and at least 2 hours of load reduction time, excluding load reduction preparation time if any, is available (AEm ≥ 120) for customers with bids for the full-period or final 2 hour event period.

- Load reduction preparation countdown begins immediately at event pending or Relay 3 is active (EPS = true).
- Load reduction is calculated on the hour.
- Load reduction ends when Relay 3 is inactive (EPS = false) and event end time.

Scenario 2: When an event pending or Relay 3 is active (EPS = true) after 12 p.m. DOE and where less than 2 hours of load reduction time, excluding load reduction preparation time if any, is available to participate.

- Do nothing!

Contact and Updates

- Assigned Technical Coordinator (TC)
- GEP | gepop@gepllc.com | 925.284.3780
- LBNL Demand Response Research Center | DRRC@lbl.gov | 510.486.6768
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The current version of this manual is available on – http://www.auto-dr.comT